Tomoo MABUCHI*, Mikinori OGISU** & Jie-mei XU**:

Chromosome number and karyotype of three species of *Anemone hepatica* group

馬渕智生*・荻巣樹徳**・許 介眉**: スハマソウ類3種の染色体数と核型

The *Anemone hepatica* group has been classified into eight species by Ulbrich (1905–06) and Hara & Kurosawa (1958). Many cytologists report that five of these eight species are diploid with a basic number of 7 or 8. Species with 2n=14 are *A. hepatica* (ex: Moffett 1932), *A. americana* (ex: Hara & Kurosawa 1958), *A. acutiloba* (ex: Langlet 1932) and *A. maxima* (Tho 1967). *A. transsilvanica* (Pop 1937, cited from Hara & Kurosawa 1958) is a species with 2n=16. Although tetraploid (2n=28) plants can be found in various places in Japan, Japanese taxonomists consider them a variety of *A. hepatica.* Hara & Kurosawa (1958) thus consider that polyploidy is apparently not an important factor in the speciation of this genus.

The present authors recently examined the chromosome number and karyotype of *A. maxima, A. Yamatutai* and *A. transsilvanica.* The results of cytological observations are briefly presented in this paper.

Materials and methods One plant of *A. maxima* Nakai from Dagelet Island, Korea, three of *A. Yamatutai* (Nakai) Hara from Mt. Emei, China and five of *A. transsilvanica* (Fuss) Heuffel from Transylvanian mountain, Rumania were used for the present study.

Root tips excised from the underground stems were pretreated with either 0.002 M oxyquinoline or 0.05% colchicine for several hrs and fixed in ethanol-acetic acid (3: 1) for 24 hrs. The fixed roots were hydrolyzed with 1N HCl at 60°C for 6 min, stained with leuco-basic fuchsin and squashed for cytological observation.

Most of the metaphase figures were sketched and suitable ones were microphotographed. Chromosome arms without the centromere region were measured with a stright ruler in the microphotographs magnified by 3015 times. Meas-

---

* Seiko High School, Naka-ku, Yokohama 231. 聖光学院高等学校.

** Department of Biology, University of Sichuan, Chengdu, Sichuan, China. 四川大学 生物系.

Tab. 1 Chromosome number (2n), number of plants examined and localities of three species in the *Anemone hepatica* group.

Species	No. of pls. examined	2n	Locality
A. maxima Nakai	1	14	Dagelet Is. Korea, alt. 800 m
A. Yamatutai (Nakai) Hara	3	28	Mt. Emei, China, alt. 1600 m
A. transsilvanica (Fuss) Heuffel	5	28	Transylvanian mountain, Rumania

urements are given in micra to the first decimal place.

Results and discussion

1) Chromosome number. The results of the chromosome count of the above three species are given in Tab. 1. Microphotographs of metaphase plates are shown in Fig. 1.

A. maxima had 14 chromosomes in root tip cells as far as it could be determined. This value is in agreement with that reported by Tho (1967). *A. Yamatutai* had 28 chromosomes. This paper may be the first to report the chromosome number of this species. *A. transsilvanica* had 28 chromosomes and thus is apparently tetraploid. Pop reported in 1937 this species to have 2n=16. However, in the present research, this number could not be confirmed. From

Tab. 2. Size of the chromosomes of *A. maxima*, *A. Yamatutai* and *A. transsilvanica* (in μm).

Chr. group	*A. maxima* (2n=14)				*A. Yama.* (2n=28)				*A. transil.* (2n=28)			
	Long arm	Short arm	Sat.	Sum	Long arm	Short arm	Sat.	Sum	Long arm	Short arm	Sat.	Sum
I	3.6	3.1	—	6.7	4.2	3.5	—	7.7	4.0	4.0	—	8.0
II	3.8	2.8	—	6.6	4.1	3.4	—	7.5	4.1	3.4	—	7.5
III	3.2	3.2	—	6.4	3.4	3.3	—	6.7	3.9	3.1	—	7.0
IV	3.3	2.9	—	6.2	3.9	2.9	—	6.8	3.6	2.9	—	6.5
V	2.9	2.6	—	5.5	3.5	2.7	—	6.2	3.4	2.9	—	6.3
VI	3.2	2.5	—	5.7	3.3	2.3	—	5.6	3.4	2.2	—	5.6
VII	3.6		0.5	4.1	3.8		0.6	4.4	4.0		0.4	4.4
							1.2	5.0			1.1	5.1

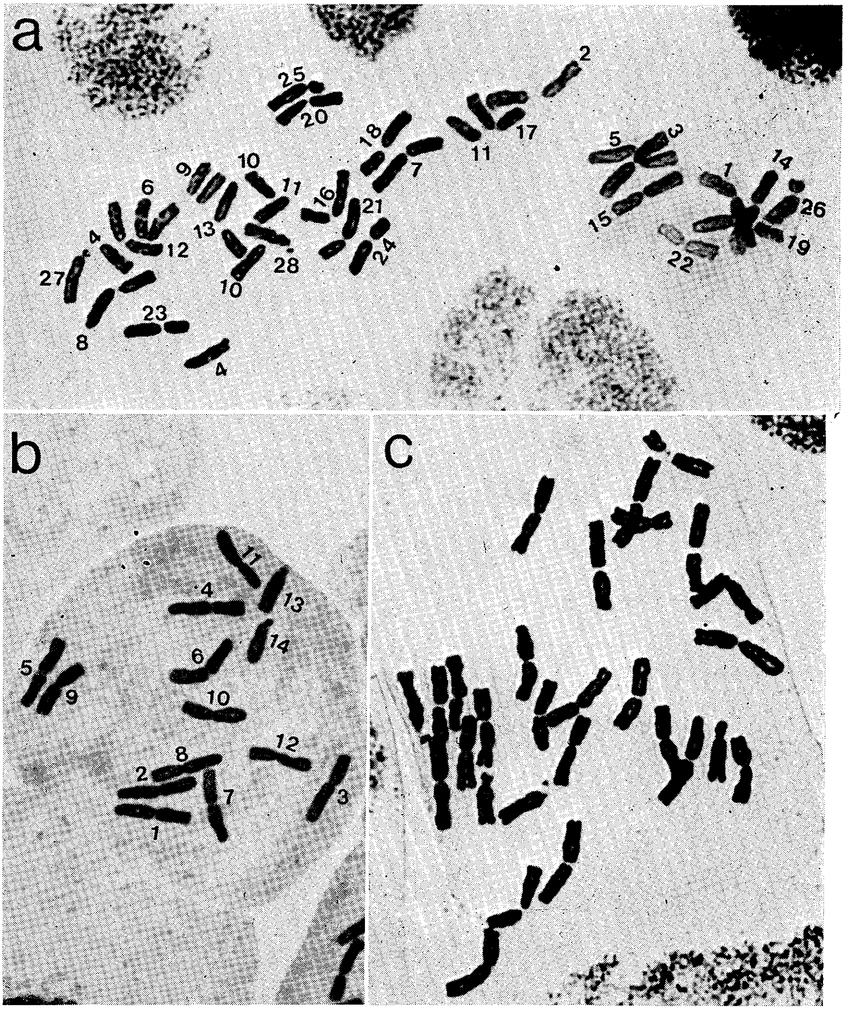

Fig. 1. Chromosomes at metaphase of root tip cells. a: *A. Yamatutai*, 2n=28. b: *A. maxima*, 2n=14. c: *A. transsilvanica*, 2n=28. ×1300.

the present results, it is also evident that polyploidy may be important to the species differentiation of this genus, a possibility at variance with Hara & Kurosawa (1958).

2) Chromosome *morphology*. The chromosomes of *A. maxima*, *A. Yamatutai*

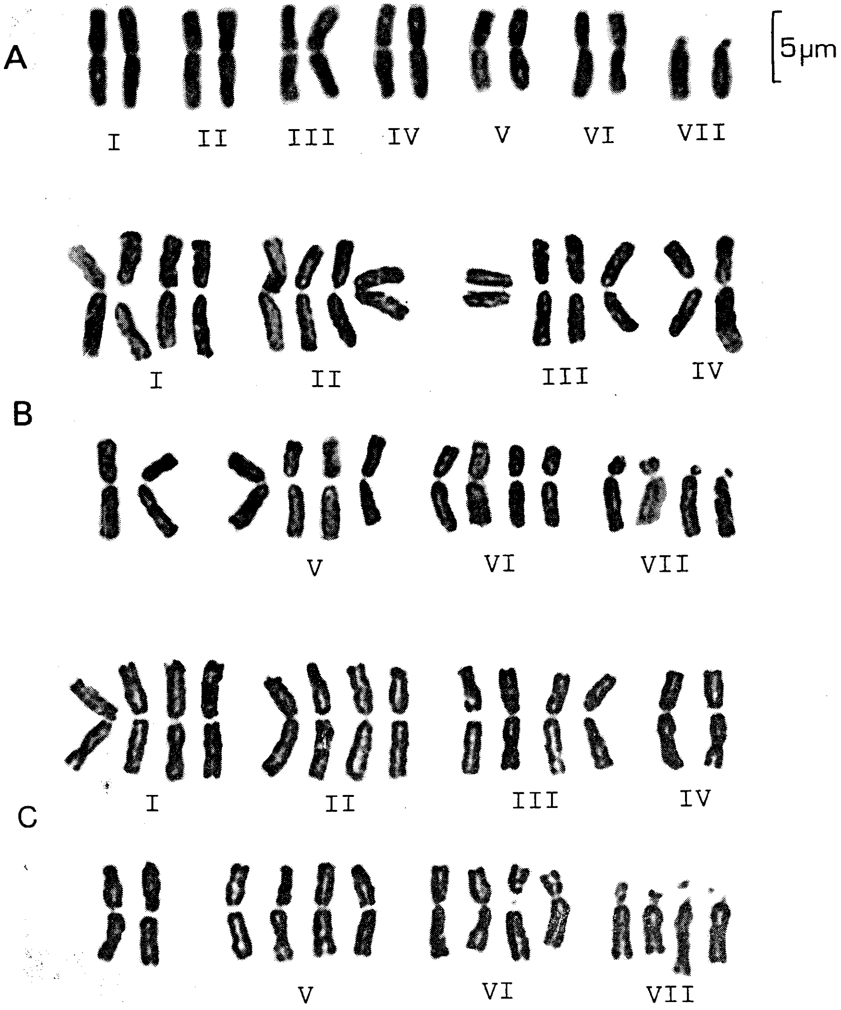

Fig. 2. Metaphase chromosomes arranged by morphological characteristics. A: *A. maxima*. B: *A. Yamatutai*. C: *A. transsilvanica*.

and *A. transsilvanica* are shown in Fig. 2 from left to right in order of the decreasing length. The size of chromosome is summerized in Tab. 2.

The chromosomes of three species are classified into seven groups by the morphological characteristics of the length and the position of the primary constriction (Fig. 2).

In *A. maxima* with 14 chromosomes, the seventh group has a sub-terminal constriction and a small satellite (0.5 μm). The others have a median or sub-median constriction. The karyotype of *A. Yamatutai* and *A. transsilvanica* with 28 chromosomes is essentially similar to that of *A. maxima.* In *A. Yamatutai,* however, the chromosome of the seventh group is heteromorphic with respect to the satellite; two have a small (0.6 μm) satellite and the other two have a large (1.2 μm) one. Such a heteromorphism of chromosomes is also recorded in Japanese varieties of *A. hepatica* L. (Mabuchi 1980). A detailed karyotype of this genus will be described in the near future.

We wish to thank Mr. Kazuo Mori for allowing us to use the material: *A. transsilvanica.*

References

Hara, H. & Kurosawa, S. 1958. Journ. Jap. Bot. **33**: 265–275. Langlet, D. 1932. Svensk Bot. Tidskr. **26**: 281–400. Mabuchi, T. 1980. Species Biology **IV**: 54–65 (in Japanese). Moffett, A. 1932. Cytologia **4**: 26–37. Pop, E. 1937. Bulet. Grad. Bot. Univ. Cluj **17**: 97–149 (cited from Hara and Kurosawa 1958). Tho, C. 1967. Journ. Korean Cult. Res. Instit. **10**: 313–317. Ulbrich, E. 1905–06. Engl., Bot. Jahrb. **37**: 172–256, **38**: 257–334.

* * * *

北半球の温帯に分布するスハマソウ類 *Anemone hepatica* group は8種よりなり，そのうちの5種は 2n=14 か16の二倍体であると報告されている。今回，筆者らは，上記5種のうちの2種と新たに1種の染色体数と核型について調べた。その結果，1) *A. maxima* は，都 (1967) によって発表されたように二倍体 (2n=14) である，2) 染色体数と核型について未決定な1種 *A. Yamatutai* は四倍体 (2n=28) である，3) Pop (1937) によって二倍体 (2n=16) と報告された A. transsilvanica は，基本数7をもつ四倍体であることなどが判明した。したがって，本調査は原・黒沢 (1958) の予想に反して，本類の種分化には倍数性が深く係っていることを明示する。また，3種間の核型に本質的な差異はみられなかった。